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Electronic Business®

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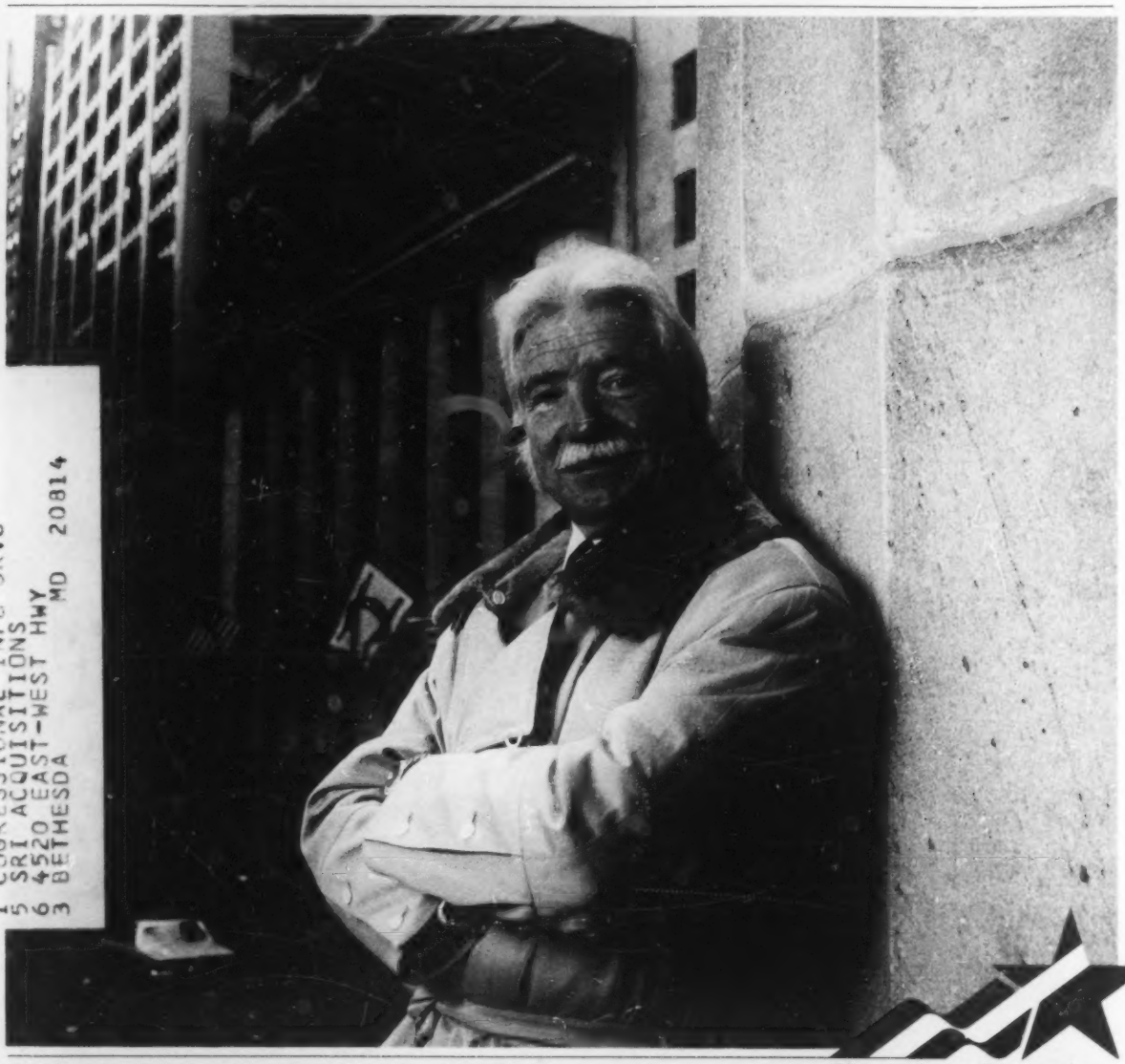
From boards to systems: AST's success story PAGE 64



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Keeping America Competitive

VOL. 14, NO. 2

Electronic Business

JANUARY 15, 1988

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Computer companies elbow into telecom international sales

But in the United States, growth for communications equipment vendors still comes from the military

Last October, big users of telecommunications equipment gathered in Geneva, Switzerland, for the Telecom '87 Show, the quadrennial extravaganza organized by the International Telecommunications Union. This is the largest world fair for manufacturers of equipment for data, text, video and telecommunications to show their wares to telecom utilities. Yet the computer companies, rather than telecom, dominated the '87 show.

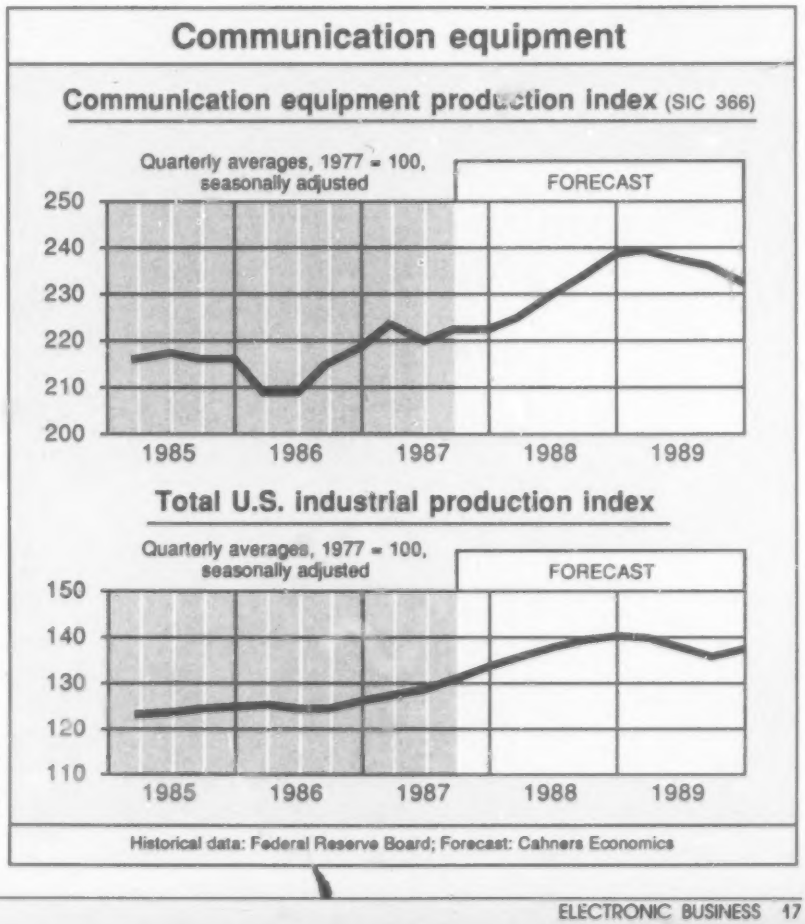
"Fifty percent of the exhibit space was taken by computer vendors," says Tim Mead, chief editor of *Datamation* a Cahners publication. He adds that this figure is "up from 20% in 1983." Mead describes the increase as coming from computer companies which are large, but still smaller than Big Blue. "IBM had a dominant booth at both shows, whereas Digital Equipment Corp. and Unisys had a much bigger presence in '87." Still, in Geneva, IBM loomed over its computer competitors just as it does in the United States, through its subsidiary, Rolm, and through its previous efforts to sell PBXs in Europe, in the telecom market. "IBM must have spent more than $10 million in that booth," remarked an envious exhibits manager of a competitor who spent "only" $1.5 million.

But even a paltry $1.5 million makes an impact. "Every vendor tried his best to show a presence in the international market," observes Penny Blaisdell, general manager for information technologies at ADL Decision Resources, which watches the international telecom market for management consultant Arthur D. Little. Trying its best has paid off for AT&T and Philips Telecommunications (APT), which was a first time exhibitor since its formation as a joint venture three years ago. At Telecom, it announced an impressive series of contracts adding up to $350 million, more than enough to pay for participating in the show.

Most of that $350 million will come from U.S. customers, but not all of the equipment will be built in the United States. In addition to the obvious participation by the giant Dutch manufacturer N.V. Philips, some of the equipment may be built in Spain by Telefónica, which will build a central office equipment factory in partnership with APT.

Indeed, production of telecom equipment in the United States grew a sluggish 4% last year, and Cahners' economist Elizabeth Baatz predicts a similar performance for this year. Yet sales by AT&T, this country's major manufacturer of such equipment, did not grow at all in 1987. Baatz explains that defense communication systems account for almost half of the Federal Reserve Board's industrial production index for communication equipment, and that was the source of growth in 1987. Aydin Corp's sales, for example, which are almost entirely for military communications equipment, increased by 5% last year. But Baatz cautions that the military engine is cooling off, and forecasts that growth in industrial production for communication equipment may crawl to less than 2% by 1989.

ALBERTO SOCOLOVSKY



Producer price indexes

Electronic components and accessories

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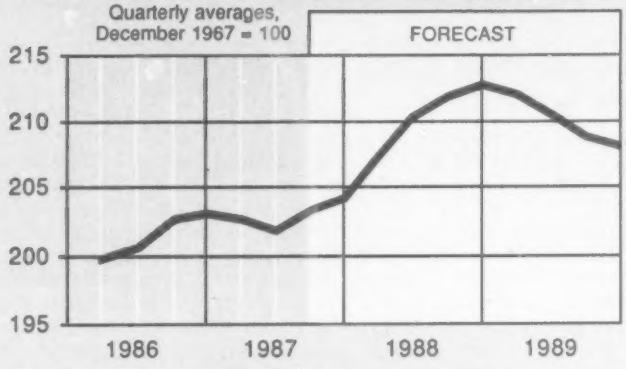
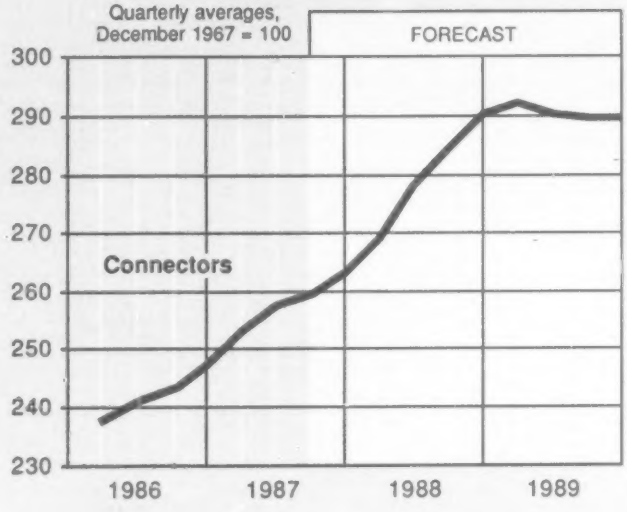
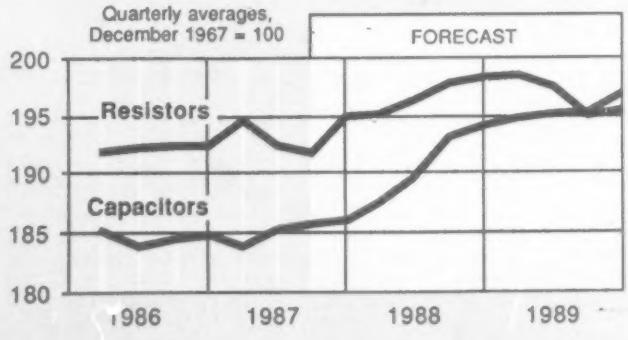


Passive components





Historical data: Bureau of Labor Statistics; Forecast: Cahners Economics

Electronic components

Producer prices of all electronic components rose 0.3% in the third quarter of 1987 above year-ago price levels. Prices are expected to pick up another 0.7% in the fourth quarter. By the end of 1987, electronic component prices will have inched up an estimated 0.7%. This is the lowest annual inflation rate for these commodities since 1976. Three factors account for today's low inflation rate: low wage inflation, low interest rates and low commodity prices. This year, these factors are expected to turn around. Component producer prices are likely to grow 3.7% this year.

Capacitors

After five years of falling prices, prices of capacitors rose an estimated 0.6% in 1987. A 0.7% inflation rate in the third quarter (compared with a year ago) and a 0.8% estimated rise in capacitor prices in the fourth quarter accounted for this increase. Rising import prices of Japanese capacitors have been largely responsible for higher prices. Also, domestic factory production of capacitors picked up sharply in 1987, pushing capacity constraints. Further evidence of upward price pressures: leadtimes for capacitors averaged 6.2 weeks in 1987 according to *Electronics Purchasing* magazine's monthly survey, about a half a week longer than in 1986. This year, capacitor prices are expected to rise another 3.1%.

Resistors

Prices of resistors fell 0.5% in the third quarter of 1987 compared with third-quarter 1986 prices, but surged an estimated 1.1% in the fourth quarter. By the end of the year, the inflation rate for resistors had picked up only 0.6%, the weakest annual inflation rate since 1984's deflation. Leadtimes for resistors stretched slightly in 1987, from 4.8 weeks in 1986 to 5.2 weeks in 1987. With commodity prices heating up, expect the producer price index for resistors to rise 1.7% in 1988.

Connectors

Rising demand for circuit boards and rising raw material costs, especially gold, pushed producer prices for connectors up an estimated 6.2% in 1987 and will lead to another 8.5% inflation rate in 1988. These inflation rates are hefty compared with other electronic components and are indeed much larger than connectors' usual inflation rates. Over the past six years, the producer price index for connectors averaged just 2.6% per year. Rising demand and supply pressures have also resulted in a half-week rise in connector leadtimes, up from 6.3 weeks in 1986 to 6.8 weeks in 1987.

To remain competitive tomorrow, firms like AMD must spend big on R&D today — and often risk Wall Street wrath in doing so

R&D

How much is too much?

By Norm Alster

Jerry Sanders has jotted down his latest estimate of calendar 1987 sales for Advanced Micro Devices Inc. The flamboyant chairman of AMD leans forward across his desk in his smartly decorated Beverly Hills, Calif., office. Sanders' sales projection — reflecting the merged businesses of AMD and Monolithic Memories Inc. — comes to $1 billion. But right next to that figure is a far more spectacular figure. Sanders has underlined the number. To its right, he has drawn a giant exclamation point. The figure — $250 million — represents AMD's 1987 expenditures for research and development. "I expect we're going to have sales at $1 billion and we will have spent $250 million on R&D." Blue eyes flashing, gold bracelet gleaming, Sanders pauses for emphasis. "A quarter of a billion dollars," he marvels.

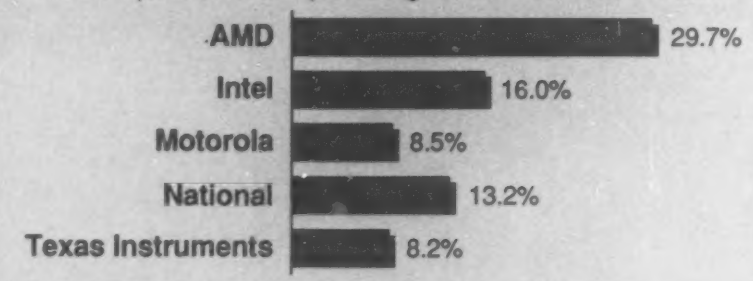
Sanders can be excused his expressions of awe. Although R&D accounting methods do vary between companies, it's safe to say that no other major semiconductor firm has come close to spending as high a percentage of its revenue on research in the last three years. Texas Instruments Inc. and Motorola Inc., for example, have been spending about 8% of revenue on R&D. Intel Corp., R&D runner-up to AMD, has been allocating between 14% and 18% to R&D over the last three years. The semiconductor industry average for fiscal 1986 was 10.6% (ELECTRONIC BUSINESS, Aug. 15, 1987).

And yet, remarkable as AMD's R&D investment level is, it actually represents a flattening off from even higher spending levels in 1985 and 1986. In each of those years, Sanders' firm spent upward of 29 cents out of

AMD's CEO JERRY SANDERS argues that he has spent big on R&D because he has had no choice: "We are spending for survival. . . . To me, the R&D issue is: are we in business or not?"

Wall Street looks beyond earnings in evaluating semiconductor firms

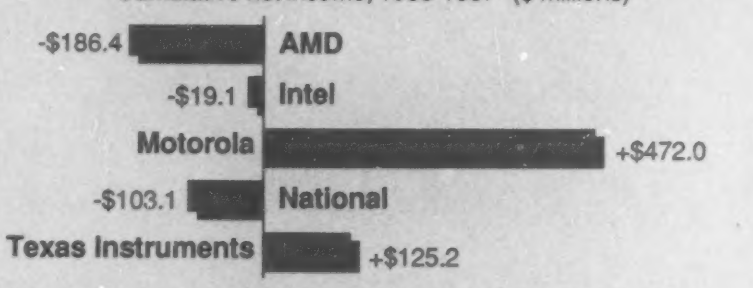
Having outspent its rivals in R&D...



* Totals for National are fiscal 1986-1987 (June 1, 1985 - May 31, 1987)

Source: ELECTRONIC BUSINESS and company reports

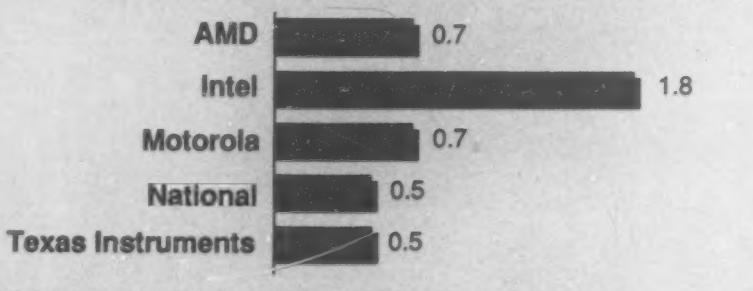
...AMD has the poorest recent earnings history



* Jan. 1, 1985 through Sept. 30, 1987; except National, which is June 1, 1985 through Aug. 31, 1987

Source: Company reports

...but its market valuation trails only Intel's



* Market price as of Nov. 13, 1987 multiplied by number of outstanding company shares

Source: Hambrecht and Quist Inc.

every sales dollar on research.

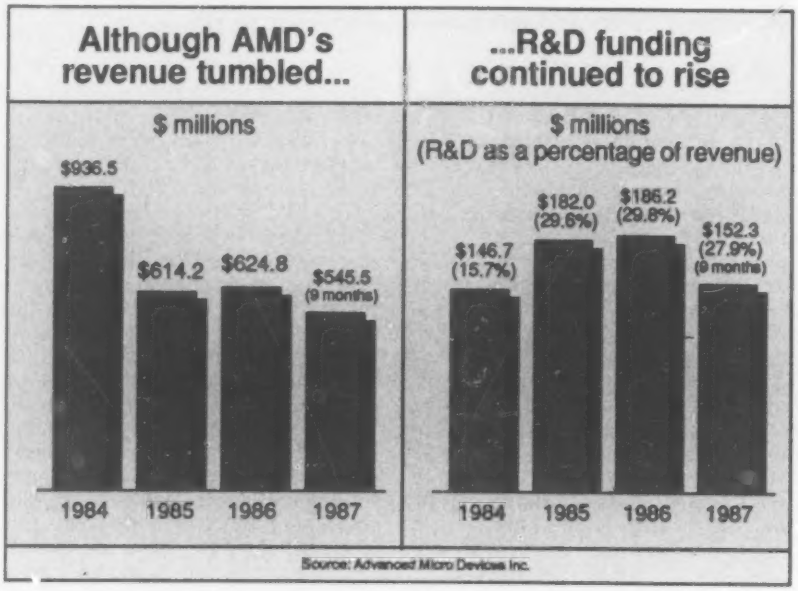
But AMD has paid the price for those outlays, losing money in nine of the last 10 quarters. In the semiconductor recovery year of 1987, AMD was a conspicuous laggard. Wall Street analysts, patient during the downturn of 1985-86, are now getting cranky, demanding some proof that all those dollars haven't just melted away in Bunsen burners. The combination of heavy investment and heavy losses is, after all, the stuff of which management-Wall Street showdowns are made.

Indeed, the AMD situation is beginning to shape up as a classic test case. What happens when an American company persists in sacrificing short-term profits for long-term objectives? No other management question holds more serious implications for U.S. industrial competitiveness. If there is one just and abiding criticism of U.S. executives, it is their focus on the short term and their reluctance (with many notable exceptions) to stand up to Wall Street and make the investments required for long-term competitive strength.

Spend big or spend well?

This is not necessarily a black and white issue. A company can spend big, for example, while not spending well. Some analysts argue that this is AMD's problem. Sanders, after all, overspent to enlarge capacity in 1983 and 1984. In early 1985, high on a cloud of phenomenal growth, he dreamed of making AMD the world's largest semiconductor company by 1990 (ELECTRONIC BUSINESS, Jan. 15, 1985). The company's sales almost immediately thudded back to earth. Were it not for its recent absorption of Monolithic Memories Inc., AMD sales would still be significantly below those of 1984. With AMD unable to capitalize on last year's semiconductor boomlet, some analysts are quite vocal in questioning the prudence of Sanders' heavy investments. "They're throwing mud up against the wall and hoping it will stick," snaps Michael Stark of Robertson, Colman & Stephens, investment bankers in San Francisco. "They've got to retrench a bit in R&D," contends Stark. "They have way too much overhead. A lot of it is R&D overhead."

Patience, patience . . . pleads Sanders. "In the last nine months we have been questioned as to whether or not we're getting an adequate return on our research and development. The analysts who follow the company's



stock are saying: 'You're spending this much money on R&D. What have you got to show for it?' My response to that is: What have you got to show for it during the months of pregnancy? The answer is you don't have much to show for it. You start to show a little bulge in the tummy. But there's nothing aesthetic about that."

Sanders says that he, too, would like to flatten AMD's unsightly little bulge. He has invested at extraordinary levels and now would be content to fund R&D at levels that are merely unusual. Having recently bowed out of static RAM development, Sanders expects to trim 1988 R&D expenditures to $240 million on hoped-for sales of $1.2 billion. Sanders knows he can't go on spending 25 or 30 cents of every dollar of corporate revenue on research. But he's done it for the past three years because he feels he's had no choice. "We are spending on R&D for survival.... To me, the R&D issue is: are we in business or not?"

Not just for you, Jerry, but for the U.S. electronics industry as a whole. Japan's nonmilitary expenditures on R&D now amount to 2.7% of gross national product, well above the 1.7% U.S. spending level. Benefits of that commitment are already evident. The U.S. Patent Office reports that four of the eight leading corporate winners of United States patents are now Japanese. With Hitachi Ltd. and Toshiba Corp. leading the way, the list of top U.S. patent grantees has begun to bear an eerie resemblance to the list of leading dynamic RAM manufacturers.

As such, it may well be that the most serious management challenge for U.S. technology firms is to resist short-term pressures from the financial community in order to make the long-term investments required for survival. The AMD showdown with Wall Street simply refocuses the old long-term versus short-term management dilemma. And since there is new evidence that the long-standing rationale for short-term focus is rooted in errant assumptions, it is worth taking another look at the whole issue.

The combination of heavy investment and heavy losses is the stuff of which management versus Wall Street showdowns are made

A suspect rationale

Any doubt that pressures against long-term planning are both real and powerful should be dispelled by a recent poll of 400 chief executives of U.S. companies, jointly conducted by *Business Week* magazine and Louis Harris & Associates Inc. The chief executives, all from the 1,000 largest corporations in America, were asked: "Industry is criticized for being focused on tomorrow's stock price and next quarter's earnings. Do you agree?" Seventy percent agreed that the criticism was "generally justified."

Pressure comes for a variety of sources — institutional investors, analysts, boards of directors and investment bankers, most notably. It has been argued that such pressures have intensified in recent years because stock ownership has become far more concentrated in the hands of institutional investors such as insurance companies, mutual funds and pension funds. Managers of institutional portfolios are under quarterly pressure themselves to outperform the overall market. They therefore look for companies with favorable short-term earnings prospects to invest in. The problem, says Robert Conrads, managing director and co-head of the technology group for First Boston Corp., a major New York City-based investment banking firm, is that management, to attract institutional investors, often adopts their short-term hor ons.

"I've seen cases where companies go off to either analysts' meetings or go with their institutional investors on road shows and come back from those trips with a specific perception of 'here's what we need to do over the next couple of years to make sure that our stock performs in accordance with our overall corporate performance.' And sometimes that's translated into decisions that affect the quarterly performance that may not be totally in line with what you'd like to see the company do over the long term," explains Conrads.

When management goes out of its way to cultivate the favor of institutional investors and analysts, long-term investments are the most likely casualty. The sacrifice of such investments has always been justified by what appears to be a compelling rationale. Simply summarized, it goes like this: the company that spends heavily on R&D (or other investments, such as capital improvements or expansion of sales, support or service capabilities) will necessarily bring less dollars down to the bottom line. Lower earnings will mean lower stock price since investors will look for a bigger and more immediate bang in more earnings-conscious firms. Depressed stock price will expose the firm to corporate raiders and the threat of hostile takeover. Low stock price will also make it more difficult for the firm to raise capital through equity offerings. The result could be

a capital squeeze since crippled earnings could also result in credit rating lowerings that would make borrowing more expensive. In short, the executive who makes "excessive" long term commitments is putting his company's financial survival, independence (and probably his own job) on the line.

That's the argument. But is any of it true? More and more, the evidence seems to be saying: No.

A recent Securities and Exchange Commission study refutes two linchpins of the argument. Kenneth Lehn, chief economist for the SEC, studied share price reaction to 62 *Wall Street Journal* announcements of new corporate R&D programs. Although such expenditures would naturally depress near-term earnings, the share prices of the companies actually outperformed the rest of the market during the next four weeks. "This evidence strongly refutes the proposition that the stock market values only short-term earnings, and not expected future earnings," Lehn concludes. Ennius Bergsma, head of the corporate finance group at consultancy McKinsey and Co. concurs, characterizing as "a fundamental misconception" the notion that share prices of companies investing in the long term are penalized. Bergsma takes issue with this assumption because it "basically presupposes that capital markets do not understand the value of basic science investment."

Financial fables

Research done at McKinsey also questions the assumption that long-term investment is penalized in share price. Thomas Woodard, a director at McKinsey, says his firm has analyzed market valuations of rapidly growing young technology companies. Woodard says that near-term cash flow prospects generally account for less than 20% of the lofty market valuations of such firms. But 80% or more of their premium valuation is based on an assessment of the company's prospects 10 years out or more. Even for computer companies with sales of $5 billion to $6 billion, says Woodard, long-term prospects account for roughly 60% of market valuation.

The SEC study also lays waste another dangerous myth: that companies which spend lavishly on R&D depress their short-term earnings and share prices to the extent that they become hostile takeover candidates. Lehn analyzed R&D expenditures of 217 target firms in the 1981-84 period. The target firms were actually found to have spent less than half of what nontarget firms in their industries had spent on R&D in the prior three years. "These data strongly suggest that investment in long-term projects such as R&D does not make a firm vulnerable to takeover," Lehn concluded.

But what of AMD? What sort of

Where AMD is spending its R&D dollars

At many semiconductor companies, device designs are the corporate crown jewels. But to a company whose roots are in second-sourcing other people's designs, process technology comes first. "Design is only a small portion of the business," contends Advanced Micro Devices Inc.'s contentious chief executive Jerry Sanders. Sanders, asked to justify his company's lavish R&D budgets, insists that he only spends what he needs to survive. And, he adds: "You cannot survive in this business if you don't have competitive process technology. Competitive process technology is expensive to develop."

But the need for process technology is but part of the reason AMD has had to pour close to 30% of all its revenue back into research in the last three years. AMD's diffused market focus, its late start in CMOS and its problems in meshing design and manufacturing have also played a part.

Despite its relatively modest size, AMD supports costly development in microprocessors, several types of memories, gate arrays, programmable array logic and other basic product groups. Thus, AMD must support research across a broad base of process technologies. Many of these processes are CMOS processes. And here, its late start in the technology has required AMD to invest big to catch up.

Sanders is loath to break out his R&D expenditures. He says only that CMOS process development has cost AMD "an enormous amount of money." And he says development of process technology overall accounts for "25% to 40%" of AMD's research budgets. Key

CMOS process development has cost AMD "an enormous amount of money"

CMOS process technology development is in the following areas: logic; electrically programmable read only memories; electrically erasable programmable array logic; and some specialty logic-intensive memories. There are also development programs in advanced bipolar processes for logic and gate arrays and in BiCMOS (a process combining bipolar and CMOS) for gate arrays. Other areas absorbing broadening streams of R&D cash flow are computer-aided design tools (enabling AMD to create semicustom versions of standard designs) and software (e.g., the assemblers and compilers for the RISC-based 29000 microprocessor).

AMD's ambitious CMOS plans have been slowed by equipment incompatibility between its process development operations (in Sunnyvale, Calif.) and manufacturing operations (in Austin, Texas). Difficulties in dimensional control at linewidths of 1.5 micron and less eventually required the company to update its plasma etch equipment in Austin. Another bottleneck: manufacturing was getting different CMOS processes from different development groups. AMD, says president Anthony Holbrook, has learned a valuable lesson. Manufacturing is now more tightly coupled with development.

Merger motivator

The merger with Monolithic Memories Inc. (interestingly, another big R&D spender, allocating more than 17% of revenue in 1986), allows AMD to eliminate overlapping and parallel efforts. One such example is in high-speed bipolar programmable array logic. The MMI effort has been disbanded, with researchers reassigned to other

stock market penalty has it paid for its spending? Here, the evidence is somewhat equivocal. On the one hand, AMD's share price has declined abruptly from its frothy highs of 1984 and 1985. On the other hand, in spite of that decline and in spite of losses approaching $200 million in the last nine quarters, the market valuation of AMD is the same as or better than those of Motorola, National Semiconductor Corp. and Texas Instruments. The key measure here is market capitalization: the price of a single share of stock multiplied by the total number of outstanding shares. This figure represents the total market valuation of a company. And the market valuation of AMD relative to its sales — while much lower than it was and much lower than that of current industry standout Intel — is (at a recent reading of 0.7) comparable to, or better than, the valuations of its competitors. The market is clearly looking beyond current problems and equating AMD's future prospects with those of its currently profitable peers.

So it appears that the logic invoked to support the short-term focus is suspect at best. But logic is not usually what drives people anyhow. Stock options and bonuses tied to earning and stock price are more powerful human motivations. The simple truth is that shortsighted management is reinforced by the financial incentives in top management contracts.

Mark Edwards, a specialist in executive compensation with Sibson and Co., management consultants in human resources, says "over 95% or virtually 100%" of chief executives in high-technology companies receive either stock options or outright grants of stock as part of their compensation packages. Edwards says that "over 90%" also receive bonuses — typically amounting to 30% to 50% of base salary — if they meet yearly profitability goals. Sanders (who insists he "never worries about stock price") admits to having lost "millions" on his AMD holdings during the October stock massacre. It would certainly take a lot of discipline to ignore those types of swings in net worth. And yet virtually every chief executive has a multimillion dollar stake in the share price and quarterly earnings of his company.

A second factor undermining long-term investment is the growing ascendancy of financial management principles within some firms. The appeal of hurdle rates, cost-benefit analysis, discounted cash flow and return on investment formulas is easy to understand. Such analytic instruments give management decisions a quantitative benediction. But do they make for better decisions? In some cases, excessive reliance on financial mangement tools may actually contribute to poor planning.

Hurdle rates, for example, require investments to yield quantifiable returns. Such economies in R&D are described by Sanders as the No. 2 motivation for the merger. An even stronger motivation was AMD's excess capacity — attractive to MMI at a time when it would have had to expand to meet demand. AMD had suffered from complementary overcapacity, the result of unduly optimistic expansion just prior to the semiconductor recession beginning in 1985. It was this expansion that has undermined much of Sanders' credibility with analysts, who wonder if he's simply repeating his mistake now by pouring dollars down the R&D hatch. Sanders' best hope for proving them wrong is a blockbuster new product.

The RISC-based 32-bit microprocessor, called the Am 29000, figures to be "far and away the biggest blockbuster," according to Holbrook. Although the product was announced in early 1987, AMD still hasn't begun shipments. Sanders insists, though, that the 29000 has generated great interest (particularly for embedded controller applications) and will be a $100 million product in 1989. Notwithstanding the blazing 17 million instructions per second speed that AMD claims for the 29000, many observers doubt that the new microprocessor can carve out that much business. If the 29000 does disappoint commercially, analyst and investor impatience will intensify.

PRESIDENT ANTHONY HOLBROOK says AMD's hefty R&D spending has produced a "blockbuster:" the Am 29000 microprocessor. But the fast 32-bit chip has yet to ship

Sanders himself admits that AMD "should have done a better job than we have in getting some of these new process technologies into production." He also concedes that AMD's R&D program will "have to do some focusing." His immediate goal is a 20% revenue increase in 1988, along with a $10 million R&D cut, that will trim R&D to a more manageable 20% of sales. Does he believe that AMD's enormous outlays will eventually justify themselves? "Absolutely," he replies, predicting that the output from AMD labs in the next five years will be "overwhelming." □

Liane Enkelis

turns of a given level — let's say 15% over a tightly defined period of time. The problem, explains Todd Hixon, vice president with the Boston Consulting Group (BCG), is that high hurdle rates discourage longer term investments. It is difficult for an investment to clear a 15% hurdle rate if it does not begin paying back very quickly. After five years, for example, that invested cash — to clear its hurdle — would already have to be worth twice as much. "It's very difficult for U.S. companies to engage in programs where the payoff is more than two years away," laments Hixon. George Stalk, a director with BCG, says hurdle rates are also dangerous because they are often applied uniformly across business units of large firms. The same return formulas are invoked for radically different types of operations: differences between globally competitive and globally uncontested; between high growth and low growth; between strategic and nonstrategic businesses are overlooked. Oftentimes, argues Stark, investments that must be made for competitive survival are vetoed because of insufficient financial "justification."

McKinsey's Woodard argues that there is a built-in flaw in the way hurdle rates and financial return formulas are commonly applied. If, for example, a company invests $50 million in a factory to build a new product, its returns would be judged against, let's say, a 10-year estimated life. This would be the period over which the investment would be depreciated. In calculating potential returns, many companies would assume that once the plant was fully depreciated, it would no longer have any value. But what if that product has allowed a company to expand its customer base? Even after the plant has been depreciated, the company still realizes the benefits of an enhanced revenue stream and broadened customer base, argues Woodard. Yet residual value does not enter into the calculations of the accountants and financial planners who hold sway at many corporations. The consequence is often an underinvestment — or, in extreme cases, abandonment of — existing businesses. A prominent example of a company that is often inordinately respectful of financial formulas is General Electric Co.

Managing by the numbers

Under former chairman Reginald Jones and current chairman Jack Welch, GE has established itself as a company with a proclivity for managing by the numbers. With financial services now accounting for more than 20% of earnings and with funds generally allocated internally according to fairly rigid financial return formulas, GE now functions more like a bank than a manufacturing or technology company. Says James Alic, a senior vice president for corporate planning with RCA Corp. before its takeover by GE, and subsequently group vice president of entertainment operations until his departure from GE in late 1986: "I think Jack Welch has been pretty clear that businesses that don't earn 15% return on investment are pretty questionable." To find such businesses, Welch has acquired cash cow operations in financial services and defense contracting (through the acquisitions of RCA, Kidder Peabody, Employers Reinsurance Corp. and others). In technology sectors (like aerospace) where profits are relatively easy to come by, GE has invested aggressively. But it has opted for the exit doors in many of the tougher core manufacturing and technology businesses. GE's recent unloading of its consumer electronics operations provides an informative case history.

After its acquisition of RCA (coveted for its broadcasting and military contracting), GE commissioned a study to examine prospects for the the combined GE-RCA consumer electronics business. This was a $3 billion-a-year business that was, according to insiders, operating with modest profitability at the time. Alic was a supervisor of the study, which got under way in early 1986 and involved several major outside consulting firms. Manufacturing, marketing and technology issues in the consumer electronics industry were all analyzed.

The conclusion, according to Alic, was that "it seemed feasible to com-

Fact versus myth: Five financial fallacies that undermine long-term competitiveness

Myth #1: When a company launches major R&D spending programs the price of its stock is likely to go down.

Fact: A Securities and Exchange Commission study found that the stocks of companies announcing such programs actually perform better than the market as a whole over the succeeding four weeks.

Myth #2: Good quarterly earnings is the key to high stock prices.

Fact: Research by McKinsey & Co. establishes that 80% or more of the valuation of high-flyer technology stocks is related to their long-term (10 years or more) outlook.

Myth #3: Companies which spend heavily on R&D are vulnerable to hostile takeover bids.

Fact: Firms targeted for takeover between 1981 and 1984 were found to have spent less than half of what nontarget firms in their industries had spent on R&D during the prior three years.

Myth #4: The paybacks from investment in R&D are chancy and impossible to quantify. You have to do some R&D, but it's too risky to spend heavily.

Fact: A nine-year study of 42 R&D investment programs found that on average they yielded returns of 300%. Depending on how returns were calculated, the annual return on investment (ROI) ranged from 20% to 35%.

Myth #5: Investing for the long term puts a permanent crimp on short-term earnings.

Fact: The average R&D investment begins to pay off in four years. Once a company adopts permanently higher R&D investment levels, it will suffer an earnings penalty — but only for those four years. After that intitial waiting period, the first expenditures start paying off and the company begins to enjoy continuing short-term benefits from its long-term investments.

GE CHAIRMAN JACK WELCH runs a company that is often inordinately respectful of financial formulas. Subordinates say Welch has been clear that businesses that don't earn 15% return on investment are "pretty questionable"

pete in the business." The consensus was that a U.S.-based consumer electronics business was "worth taking a shot at." Another direct participant in the study (who asked not to be identified) says it was felt that with the proper investment and commitment, GE could probably "slug it out" in consumer electronics, making "respectable" profits.

GE was encouraged to slug it out for a basic reason beyond immediate profitability: consumer electronics has significant strategic value. Televisions, video cassette recorders and video cameras are products where sophisticated new electronics technologies are first produced in high volume. Television manufacturers are likely to be the first to apply high-volume production to digital signal processing and flat-panel display technologies. Video cameras have already revolutionized the pricing of photosensors, giving tremendous competitive advantages to their Japanese manufacturers. The Japanese, of course, have benefited repeatedly from introducing advanced electronics into high-volume consumer electronics applications. "I think a Japanese company would have kept it. That's the distinction. The Japanese would have said: 'There are some strategic elements to this.' And there are," reasons the GE insider.

But GE-RCA managers were told they had two years to spruce up the bottom line. "What you saw from the top management at General Electric was the classic 'you've got two years' kind of thing. Besides which, they didn't have a lot of appetite for that kind of business," adds the informed source. In the end, GE would not even give consumer electronics that long, choosing to trade the business to French electronics conglomerate Thomson CSF for its more glamorous, presumably higher-growth medical electronics business. Why slug it out tooth and nail with the Japanese and Koreans in manufacturing when you can sit on fat market share and a head start in technology and simply milk (what for the time being is) a sure thing?

Industry whipping boy

Of course, there is an alternative to management by the numbers. Sanders, in this respect, can take heart because his R&D funding methods closely track those of Digital Equipment Corp., a company he'd do well to emulate.

DEC has been flying high for some time now, but from 1983 to at least mid-1985 the company was the industry whipping boy, regularly rebuked for its poor financial performance and product deficiencies. DEC had a clear choice: It could curry favor with Wall Street by trimming investments, abandoning a no-layoff policy and announcing a shareholder dividend. Or it could accelerate long-term investment, even at the cost of eroded margins.

During these dark days, reports

The most serious challenge for U.S. high-tech firms may be to resist short-term pressures from Wall Street and make the long-term investments needed for survival

Samuel Fuller, DEC's vice president for research and engineering, the company was not funding R&D according to the numbers. "There was a lot of argument inside the company," recalls Fuller. Engineering vice presidents would outline their own future product and technology needs, only to be reined in by financial analysts within DEC invoking return on investment formulas. DEC chairman and chief executive Kenneth Olsen, says Fuller, ensured that the engineering chiefs got a fair hearing. Never mind if their proposals violated financial formulas.

SAMUEL FULLER, DEC'S R&D CHIEF, says DEC chose not to fund R&D according to the numbers. The result of its $3 billion R&D spending was one of the most extraordinary new product blitzes in computer industry history

In the end, Olsen steered DEC toward a consensus for heavy development budgets, even if they temporarily crimped margins. DEC wound up spending $3 billion in research during a four-year period. The result was one of the most extraordinary new product blitzes in computer industry history as DEC trotted out an average of one major new system a month between January 1986 and March 1987 (ELECTRONIC BUSINESS, May 15, 1987). DEC's dramatic turnaround reestablished the Massachusetts giant as the fastest growing multibillion dollar company in the computer industry.

Sanders should also be encouraged by the results of what is to date the most definitive study on the efficacy of R&D. Using data from the Strategic Planning Institute, researchers tracked the investments of 42 U.S. business units over a period of nine years (1971-1979). On average, R&D investments were found to have a payback of 300% over the period (or 20%-35% on an annualized basis), according to David Ravenscraft, an associate professor of business administration at the University of North Carolina at Chapel Hill. The bottom line is that the average investment in research pays off.

Unless Jerry Sanders has made an awful lot of below-average R&D investments, AMD's bottom line should begin to improve. Sanders has done well to spend big. Now he must only prove that he has spent well. □

RichFriedman/Black Star

MICROCOMPUTERS

AST Research: The board maker that is making all systems go

AST's transition to PC-making is working well. But recent profit fizzles prove the firm still has lessons to learn

By Bruce C.P. Rayner

Just what the world needs: another personal computer, right? Well, according to AST Research Inc., that is exactly right: a high-performance machine, aimed at the power user, that will give high-end producers like IBM and Compaq Computer Corp. a run for their money. In spite of some initial rockiness, AST is showing signs of having what it takes to be a serious contender in the microcomputer systems business.

Already, over half of the Irvine, Calif., firm's sales are from systems. And its hot PCs, unveiled just over a year ago, continue to attract buyers. But the metamorphosis from respected board maker to aspiring systems company is not without headaches. Winded by IBM's introduction of the Personal System/2, AST has had to write down inventory of add-in boards for older PCs. And it must brush up on its distribution techniques and deal with the lower gross margins of the systems business.

AST's three visionary cofounders — Albert Wong, Safi Qureshey and Thomas Yuen, whose first names form the firm's acronym — claim that the transition to systems sales is all part of their long-term plan. They founded AST as a consultancy in 1980, and set about building a company that one day would enter the systems market. In 1983, president Qureshey stated that "in three to five years, we will become a $200 million company with three divisions." The $200 million and the three divisions — boards, datacommunications and PCs — are now a reality. For the fiscal year ending June 30, 1987, AST produced sales of $206 million, with net income of $13 million.

The company's capital base was built by penetrating the interior of the IBM PC. With a series of enhancement boards, AST managed to cap-

James Cacioppo

AST's YUEN, WONG and QURESHEY (left to right) are confident they can put a dent in IBM's armor with their new Premium/386 machine

ture a piece of the PC market and at the same time develop a reputation for quality and service. Board sales rose from $12.78 million for fiscal 1983, to $172 million by 1986, and net income grew from $1.6 million to $27.7 million.

Today, the company boasts that AST's board products account for about 70% of all IBM's third-party service contracts. With the groundwork laid and brand recognition established, AST is now playing both sides of the net. It continues to support IBM products, including the PS/2 products, with its enhancement products — although somewhat late in bringing its products to market — and now it is stepping into the ring with Big Blue as a direct competitor.

By early November, just short of a year after shipping, AST had sold 50,000 units of its IBM PC-compatible Premium/286 machine, and the company is currently ramping up production on its second-generation products: the Premium/386, an IBM PS/2-compatible, and the small footprint AT-compatible Premium workstation. In terms of market share — 0.6% of the United States PC market — AST is still insignificant. But then Rome wasn't built in a day either.

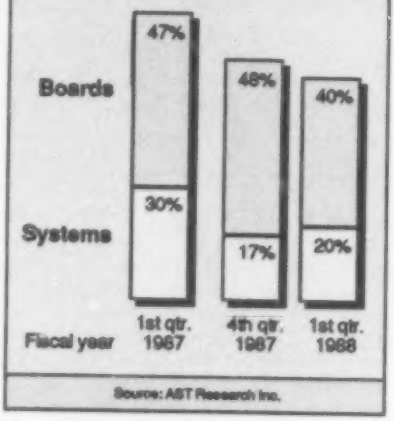
The company is convinced that as more users are turned on to the power of the AST machines for business, CAE/CAD/CAM and desktop publishing applications, their popularity will follow. "We feel that if the user can get their hands on it, they will buy it," claims executive vice president Yuen, the marketing tactician of the founding team. Many users agree.

"AST is going in the right direction," says Julie Irving, corporate personal computer coordinator for Pacific Financial Companies, formerly Pacific Mutual. PFC recently bought 230 Premium/286s and will be buying more in the future, says Irving. Similarly, Robert Holman, director of engineering at Amphenol fiber-optics products division, a part of Allied Amphenol Corp., is favorably impressed with the Premium/286. Holman says the AST machine runs spreadsheets between six and 16 times faster than conventional PC clones and about two to four times faster than an IBM AT.

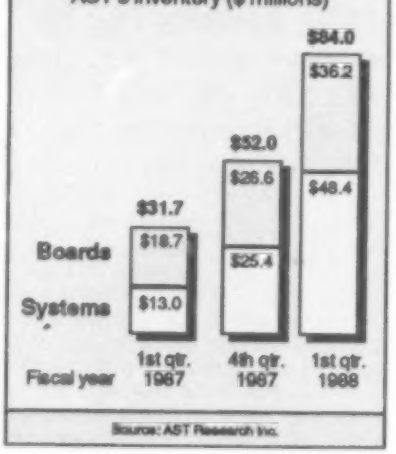
Fickle PC business

AST is not daunted by the fight that lies ahead. But success in the fickle PC business depends on how successfully the company can restructure itself internally; it depends on how it allocates its research and development monies in the future; and it depends on how effectively the company can get its products to market.

AST must learn to deal with the lower margins of the systems business



Hit by IBM: The PS/2's debut has left AST with more inventories than it cares for



The transition began back in 1986 and is winding down now, claims AST's Yuen. The need for restructuring was never doubted, but the perception of AST as a company in turmoil is wrong, he says. With revenue doubling in six months and a product mix going from 80% boards to 60% systems, short-term growing pains were unavoidable. The changes were anything but haphazard. They were "designed," and as a result, the outlook for 1988 is very optimistic, says Yuen. "I think AST's performance will surprise a lot of people, including some of our own skeptics within AST," he adds. He is forecasting the systems market to grow at a 25% clip and for AST to outperform the market.

To ease the growing pains, AST has separated its three product lines into independent divisions. Each has its own senior vice president responsible for the marketing, sales and engineering functions. In addition, there are the corporate divisions which cut across product lines: research and development; worldwide manufacturing; the corporate sales operation that focuses on developing major corporate accounts; and administration.

But independent sources claim that some key issues still have to be resolved in the restructuring. Most notable in those changes is the integration of AST's Apple Computer Inc. enhancement board products into the board division, says Benny Lorenzo, a vice president and AST watcher at L.F. Rothschild, Unterberg, Towbin in New York City. Lorenzo also insists that AST needs to strengthen its control over worldwide manufacturing operations, since improved communications to the Far East facilities are crucial to keeping costs under control.

As far as distribution and marketing of the new systems, AST still has a long way to go. The strategy so far has been to develop a two-tiered selling approach, whereby AST develops corporate leads by offering its systems for an extended trial period to a targeted corporation and then lets a value-added reseller or distributor make the sale.

For resellers that have taken on the AST line, it has proven successful. The Computer Store Inc., a $5.3 million Santa Monica, California-based reseller, has expanded its AST systems business so much in the last eight months that it's now the firm's primary corporate computer, says Bonnie Scott, the reseller's major accounts coordinator. "Acceptance is strong because of brand name recognition," she says.

But the size of AST's distribution network is a major limitation at this time. Even though about 700 resellers carry the systems products, AST has not yet established a corporate-wide franchise with one of the big chains,

such as ComputerLand Corp. or Businessland Inc. There are independent franchise arrangements with some ComputerLand stores, but AST has yet to crack the boardroom of either chain.

While IBM and Compaq are aiming at those retail chains in the top 20% for sales, Yuen has initially targeted the lower 80% of the resellers. But the list also includes some of the most well-respected names in the business: resellers like Micro D Inc., Microamerica Inc. and Tech Data Corp. are selling AST's systems, says Yuen.

But original equipment manufacturer deals — in which the OEM slaps its own name on the AST-made box — are also being considered by AST. Currently, the debate is over how to best penetrate the Japanese market that has traditionally been closed to U.S. personal computer makers, including IBM. AST is considering whether or not to pursue a Japanese OEM to market the AST computers, says Wesley Nelson, vice president for international sales.

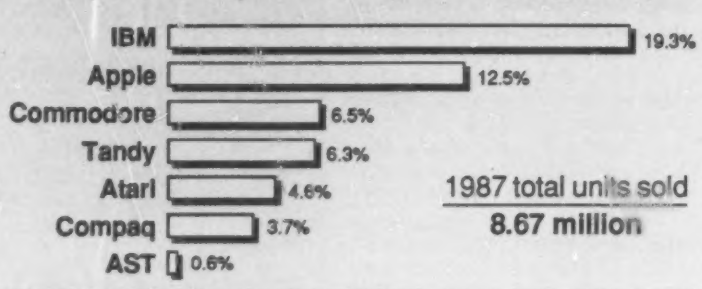
External factors are also at play in the long-term success of AST's systems. The switch by IBM to the PS/2 PC, introduced in April of 1987, dealt a serious blow to AST's existing PC AT and XT board business. The new environment will also determine how well AST's new PS/2 board products pick up the slack.

Also, the standard being set by the new IBM Micro Channel — the multitasking bus system that takes full advantage of the power of the new 80386 processors — is being challenged by AST with its own proprietary SMARTslot architecture. The SMARTslot is compatible with the AT bus and is designed for multiuser environments. Whether or not SMARTslot catches on as an alternative to the PS/2 architecture will play a role in the success of the Premium/386. "If it is picked up by the industry, then we will really put our emphasis on [the SMARTslot]," comments Yuen.

But skeptics abound. Harvey Allison, a vice president for securities firm Wertheim, Schroder and Co. in New York City, says the advantages of the SMARTslot are very "iffy." He does not think an AST slot innovation is as interesting to the market as a new architecture from IBM.

Yuen sees the shift to a PS/2 environment as an advantage for AST, whether SMARTslot catches on or not. "IBM's move to stop manufacturing the PC AT and XT is a change that is creating a lot of opportunity," he claims. It enhances AST's ability to serve the existing PC AT and XT base and improves its ability to migrate these machines, along with its own Premium/286, up to the more powerful 80386 environment. Also, the Premium/386 runs at three speeds and is compatible with existing AT software. Because of AST's two-pronged market presence, it is able to capitalize on both the successes and failures of the PS/2: "We don't get mad with IBM," quips Yuen. "We are friends and foes."

In 1987, AST is still a minnow in PC seas



Source: Dataquest Inc.

AST forecasts that the systems market will grow at a 25% clip and that it will outperform the market

AST recently announced an expanded memory board for the PS/2 models 50 and 60, the Rampage/2-386, and one for the PS/2 model 80, the Advantage/2-386. It also introduced two boards that will handle the memory requirements of Microsoft's new OS/2 operating language.

Despite some problems on the balance sheet and income statement, most analysts are confident that AST can pull the transition off. "I think they understand what their problems are, they are working on it and they will make it," says analyst Lorenzo. The growing pains, however, are very real.

Lorenzo criticizes the company for losing focus of its board business as it grew its systems business, charging that AST left an opening for competitors to attack its board base. He also chides the consensus management style of AST's founders as being too time-consuming in such a swiftly changing market. "The founders have to delegate more responsibility and accept that they cannot oversee everything," Lorenzo says.

As a result of both internal and external factors, AST took a hit in the 1987 September quarter — the fiscal 1988 first quarter — as net income skidded to $72,000, down from over $8 million for the same quarter one year earlier. "It was a real disappointment both for Wall Street and for themselves," says Lorenzo. Despite healthy sales for the September quarter, inventories rose precipitously, net income was way down and AST's usually strong cash position was compromised. Higher expenses and a drop in PC AT and XT board sales caused by the transition to the IBM PS/2, have left the company in a weakened financial position.

"It's a problem, no doubt about it," agrees Blake Childs, an analyst with the Los Angeles firm of Bateman, Eichler, Hill, Richards Inc. Of AST's $78 million September quarter sales, only $30 million was in boards. Board sales were off about $9 million, or 22% from the previous year. Childs estimates that about 40% of AST's board sales were for IBM PC machines. When the PS/2 hit the market, people stopped buying add-on boards for their PCs and AST was forced to write down about $2.7 million worth of inventory on board level products.

Childs expects another write-down in the December 1987 quarter, but an AST spokesperson claims that will not happen, pointing out that as the new AST PS/2 boards begin to take off early this year, they will compensate for the drop in traditional board sales. Still, the company concedes that "inventory levels are higher than we would like."

As for the paltry net income in the September quarter, it can be traced to a few sources. Gross margins on

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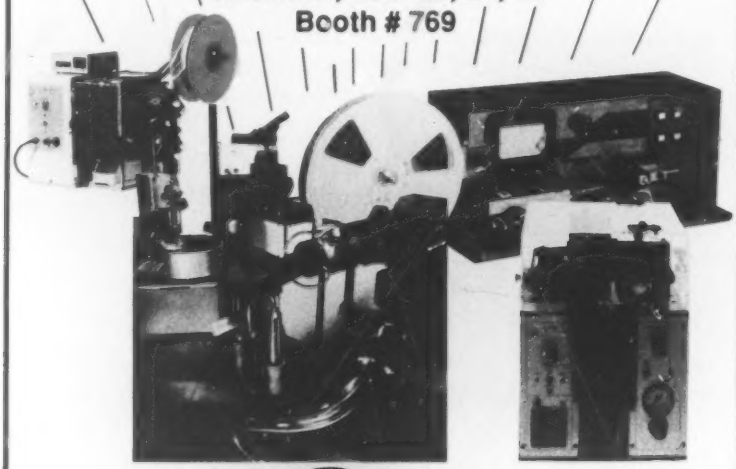

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boards traditionally run between 45% and 50%, while systems only average in the low 20% range, and higher inventory levels tend to pull margins down. The start-up costs involved in penetrating a new market and restructuring the company are also reflected in the lower net income. Most notably, research and development costs are higher. For fiscal 1986, R&D was over $11 million, compared with $8 million for 1985. The company claims that R&D will stay in the $11 million range for the foreseeable future, but will decline in significance as revenue grows.

Despite the poor financial showing, AST is not about to retreat. Besides its Irvine operation, AST has a two-and-a-half year old manufacturing facility in Hong Kong — home of founders Yuen and Wong — and is setting up a manufacturing plant in Taiwan to cater to the systems business. It also has marketing offices in Australia, Britain, Canada, France, Germany and Hong Kong. As in the United States, the company prefers to sell through resellers and distributors internationally. AST derives about 25% of its revenue from overseas sales, two-thirds of which is from Europe. "We continue to believe that the majority of our product has to be made in the U.S., but we can use the overseas strategy to help us compete against people like IBM," says Yuen.

The Pacific Rim is one of the fastest growing markets for personal computers, and AST is hot on the trail. In November, after only six months of pushing the systems overseas, the company announced two important deals in Hong Kong for the sale of Premium/286 machines: 50 units for the Bank of Hong Kong and 270 units for the government of Hong Kong. "We are hopeful to ship double the original order quantities by the end of June 1988," claims AST's Nelson. The sale to the government of Hong Kong is a feather in AST's cap because AST is now the standard by which future government purchases will be judged.

Other Pacific Rim countries that AST is targeting are Thailand, Singapore, Malaysia and Indonesia. The Thai market is particularly promising because AST's local distributor has mapped the screen into the Thai language. "We are perceived as a company with an international image but local content, which is always our goal at AST International," says Nelson. □

MILITARY ELECTRONICS

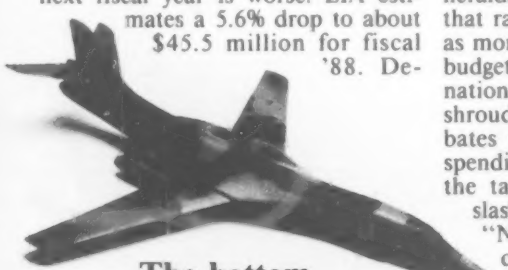
Defense spending: Sorry, but it's down for the decade

And defense electronics is down with it. But war games, C3I and space offer some relief for alert military contractors

By Bruce C.P. Rayner

After months of haggling, Congress and the White House finally agreed in late November to cut about $30 billion from the 1987 federal budget, just enough to sideline the Gramm-Rudman automatic spending cuts of $23 billion. The consequences for defense spending were as expected, with cuts of $5 billion, producing a total budget of between $289 billion and $295 billion. Still, defense contractors will have to get used to a perpetually shrinking defense budget for the next few years, as Congress grapples with trade and budget deficits.

The bottom line for the electronics content of the R&D and procurement categories of the defense budget is a $1 billion cut to $48.2 billion for fiscal 1987, beginning last October, estimates the Electronics Industry Association (EIA). The outlook for the next fiscal year is worse. EIA estimates a 5.6% drop to about $45.5 million for fiscal '88. Defense electronics will continue to contract through the early 1990s, somewhat more slowly than the general defense budget, and will remain pretty flat through to 1997, the EIA forecasts. However, the percentage of spending on electronics will increase to around 40% in 1988 and hold its own through 1997.



The bottom line for the electronics content of the R&D and procurement categories is a $1 billion cut to $48.2 billion for fiscal 1988

"There is no safe place to hide; everybody will feel it," comments Byron Callan, defense electronics analyst with Prudential-Bache Securities Inc. in New York City, referring to the defense squeeze. Acquisition activity will increase and competitive pressures from both domestic and foreign companies will intensify now that the pie is smaller, he says. With the budget cuts exacerbated by mounting economic concerns, the defense marketplace will be an altogether tougher place to do business.

The contracting defense budget heralds a new congressional austerity that ranks domestic economic issues as more critical than a static defense budget. The concern with the huge national debt and trade deficit is a shroud that will hang over budget debates well into the 1990s. Defense spending, most analysts agree, will be the target for future congressional slash-and-burn exercises.

"No one is immune from the cuts," says Barbara Bruser, senior defense research analyst with the Security Pacific Merchant Bank, in Los Angeles. "It will affect the defense electronics companies as much as it will affect everybody else," she predicts.

The immediate consequence of the defense cuts, electronics included, will be to put a squeeze on weapons research and to stretch out the procurement of new systems. While the prime contractors will feel the pinch immediately, it will take a while for the full impact to ripple down to subcontractors. The cuts are selective, based on need and practicality — the House of Representatives slashed a computer for the Army command and control system (ACCS), the Advanced Field Artillary Tactical Data System (AFATDS) and other multimillion dollar projects for fiscal 1988 with one stroke of the pen —so the luck of the draw appears to play a role in who gets hurt and who does not.

Martin Cooke

Space electronics and the training and simulation market are two examples of positive growth areas

The electronics and communications category of the Department of Defense's research and development and procurement is expected to grow from $9.1 billion in 1987 to $9.3 billion this year, and will reach a peak of $10.1 billion in 1989 before leveling off at $10 billion through 1992, the EIA predicts.

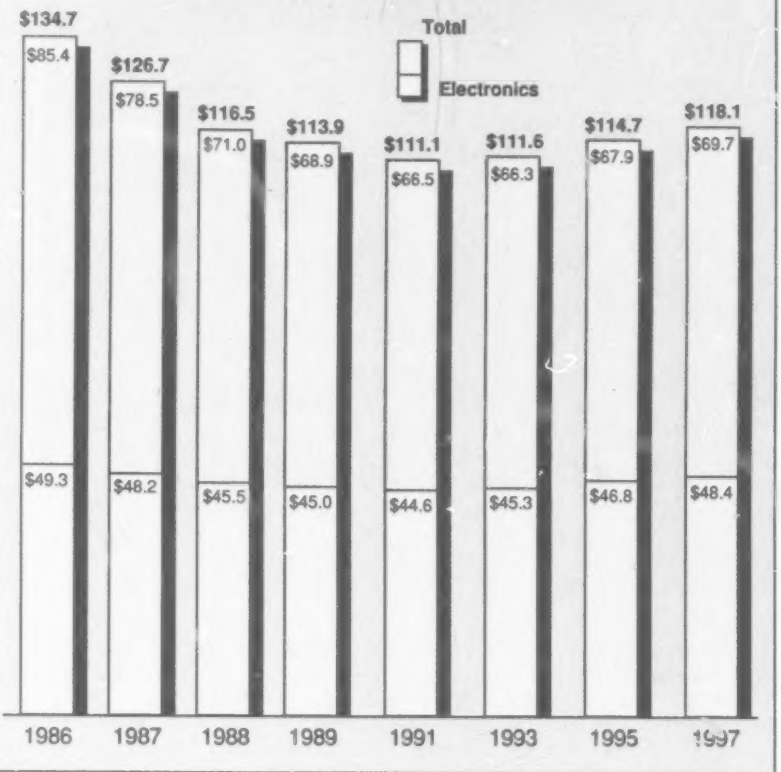
New reality

This DOD spending contraction is the new reality. But it is not as bad

Defense scorecard: Congress 1, Pentagon 0

Defense electronics will continue to contract through the early 1990s and will remain fairly flat through 1997, but the percentage of spending on electronics will increase to around 40% in 1988 and hold its own through 1997

Total DOD procurement and RDT&E budget forecast
(Constant FY 1988 $ billions)



Source: Electronic Industries Association

as it sounds, at least not for those companies that have their resources in the right places and are heavily involved in electronics. Looked at from a long-term perspective, the actual size of defense spending remains significantly higher than it was through the 1970s. Looked at from a long-term perspective, this dip is a part of the natural cycle in defense spending. After the 8% annual real growth in military spending of the early 1980s, the slowdown was a sure bet.

"We watch our programs very carefully, and at the moment it appears that we are going to come out pretty well," says Larry Hallfin, director of business and strategic planning for Honeywell Inc.'s aerospace and defense business. The reason, says Hallfin, is that Honeywell is a subcontractor for avionics, marine and space electronics, three areas of defense spending that will remain relatively steady.

Subcontractors like Honeywell feel somewhat insulated relative to prime contractors. As contracts for platforms — ships, planes and tanks — get cut, prime contractors feel the impact immediately whereas subcontractors can shift their attention to retrofitting or upgrading existing inventory. Hallfin estimates 6% average growth for Honeywell's defense electronics business in 1988. "We recognize that the budget is flat and don't see renewed growth, but we teink we are pretty well positioned," he adds.

But why settle for flatness? "There are still pockets of growth in the shrinking overall budget," comments the optimistic Lior Bregman, defense electronics analyst with the consulting firm of Hambrecht and Quist Inc., in San Francisco. Space electronics and the training and simulation market are two examples of positive growth areas that Bregman identifies.

George Brown, executive vice president of the Lexington, Massachusetts-based economic forecasting firm of Data Resources Inc., and a longtime Pentagon watcher, suggests that command, control, communications and intelligence (C^3I) is another growth area. This category includes space programs like MILSTAR satellite upgrades as well as ground-, sea-and air-based communication systems. Another area of growth is research in antisubmarine weapons systems — a market that both IBM and AT&T are actively involved in —that is a high priority given the recent advances in Soviet submarine technology. The real weaknesses will be in weapons and tracked vehicles, some aircraft procurement as well as slippage in the ship-building budget, Brown esti-

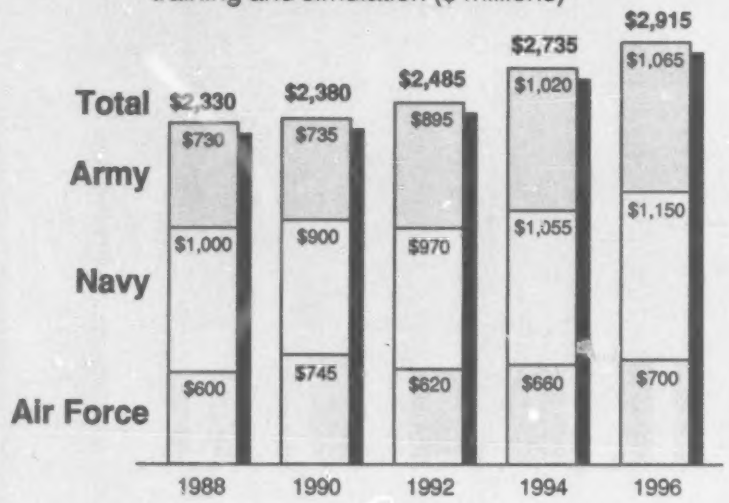
Martin Cooke

EIA estimates that the training and simulation market is currently worth more than $2 billion annually

War games, anyone?

Alert defense contractors are finding that the market for electronic equipment used for training and simulation is worth over $2 billion, and is growing

DOD budget for electronic equipment used for training and simulation ($ millions)



Source: Electronic Industries Association

mates. Electronics research and development in general will remain healthy through 1989, he adds.

Similarly, the space budget, that includes Reagan's Strategic Defense Initiative (SDI), will continue to grow through the 10-year EIA forecast period, posting $6.3 billion for 1988. Although diverging significantly from the $5.2 billion DOD request, SDI will account for over $3 billion of total space monies in 1988, the EIA projects.

For companies like M/A-COM Inc., the Burlington, Massachusetts-based electronic warfare, missile guidance systems and satellite communications subcontractor, the space budget is not such bad news. "These [tactical] areas, if they follow the same trend that has been happening since 1985, will probably be less impacted than the strategic areas and areas such as the large phased-array radars where the money has been slow," comments Joseph Bothwell, M/A-COM's senior vice president. But still, some of M/A-COM's orders have been delayed since 1986 due to budget cuts. Says Bothwell: "It is possible that those orders may be delayed until 1989."

Milton Silveira, director of advanced requirements and analysis at Ford Aerospace & Communications Corp., claims that even though the overall defense budget will be going down, C^{3}I will remain pretty flat or could possibly even increase. "I wouldn't say it is healthy, but [C^{3}I] looks to be one of the more promising areas," he says. As a result, Ford Aerospace is concentrating a lot of its efforts in the C^{3}I area for the Army, Air Force and SDI, Silveira adds.

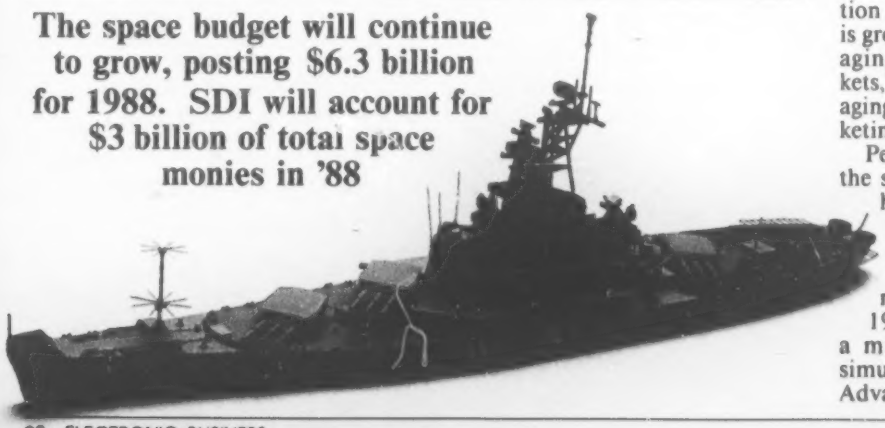
C^{3}I will continue to be relatively healthy because it acts as a "force multiplier" that lets a commanding officer get more value out of his resources. In essence, it is a cost-effective investment that enhances hardware and manpower capabilities. The same goes for simulation and training equipment. Instead of training pilots in real F-16s, or tank drivers in real M-1 tanks — equipment that can wear out, use fuel and can crash —a sophisticated simulator is substituted. It takes advantage of artificial intelligence and satellite networking so simulators around the world can be hooked together for simulated battles. As a result, any procurement that will ultimately save the Pentagon money is pretty much a sure bet these days.

The EIA estimates that the training and simulation market is currently worth more than $2 billion and is "growing moderately." It includes antisubmarine weapons (ASW), electronic warfare (EW) training systems, command and control trainers and flight simulators, that in some cases are made up of over 90% electronics.

Imaging Technology Inc., a $15 million privately held Woburn, Massachusetts-based subcontractor making simulation weapons and flight systems, is profiting from the simulation market. "The defense business is growing, definitely growing, for imaging processing in military markets," insists Robert Birenbaum, Imaging Technology's director of marketing.

Perceptronics Inc., a rising star in the simulation market, is also riding high. The Woodland Hills, Calif., company doubled sales from $15 million in 1985 to nearly $30 million in 1986 and reached $38 million in fiscal 1987. Perceptronics is involved in a multimillion dollar, large-scale simulation network with the Defense Advanced Research Projects Agency

The space budget will continue to grow, posting $6.3 billion for 1988. SDI will account for $3 billion of total space monies in '88



Martin Cooke

(DARPA), called the SIMNET. The SIMNET program includes several hundred simulators of various types, including the M-1 tank simulator networks.

On the component level, both the very high-speed integrated circuit (VHSIC) and the gallium arsenide (GaAs) monolithic microwave integrated circuit (MIMIC) programs are slated for applications in military hardware and look to have steady growth through the 1990s. The $336 million DOD-funded VHSIC phase-two research jprogram will wind down in 1989, and by 1992 VHSIC chips will find their way into missile guidance systems, signal processors and radar systems. MIMIC is only about a year old and is still in the early stages of research and development.

"VHSIC is important to us not simply for the sales of VHSIC technology, but for the insertion into systems. It will give us leverage in our systems business," says John Mellen, director of strategic planning and analysis for TRW Inc. VHSIC will be used in TRW's integrated avionics, electronic warfare systems and in space applications such as the MILSTAR satellite.

The "black" defense budget is growing "astronomically" to an estimated $22 billion for fiscal 1988, up from about $4.6 billion in 1984

TRW is also involved in the phase zero, or research stage, of the MIMIC program, teamed with Honeywell Inc. and General Dynamics Corp. for about $1 million in DOD funds and is bidding on phase one this year. There are about 12 teams at the phase zero level; each has about $1 million in funding. MIMIC is complementary to VHSIC in that it represents the analog front end of weapon or command and control systems while VHSIC is the digital brain.

Black is beautiful?

While growth can be identified in some military markets, it is a guessing game in others. The "black budget" — those programs that are kept under lock and key for security reasons — are hard to gauge, both in terms of size and in terms of growth potential. It is rumored that some black projects that are budgeted to one agency, such as the Central Intelligence Agency, can find their way into the DOD budget, and vice versa. Keeping track of the black budget is no easy task.

The Center for Defense Information (CDI), in Washington D.C., estimates the black budget at about $22 billion for fiscal year 1988, up from an estimated $4.6 billion in 1984 and $19 billion in 1986: a growth rate that CDI senior analyst Brian McCartan calls "astronomical."

McCartan estimates that about $15 billion of the $22 billion is for the Air Force including: the B-2 stealth bomber, built by Northrop Corp.; the F-19, built by Lockheed Corp. with about 50 currently operational; and the stealth cruise missile. The remainder of the $22 billion is shared between the Navy, for its stealth advanced tactical aircraft (ATA), with a total price tag of $45 billion over its production lifetime, and various space research projects, CDI estimates. Although no hard facts are available, much of the black budget is in advanced electronics.

Because electronics accounts for about one-sixth of the total DOD budget, most prime contractors are positioning themselves to capture a piece of the high-tech action. Bruser at Security Pacific sees the trend for prime contractors getting into the systems and subsystems market intensifying.

Industry experts agree: "You are going to see more consolidation in the industry," says TRW's Mellen, with airframe houses acquiring electronics firms. Recent examples of this trend include Lockheed buying out Sanders in 1986, Boeing acquiring Argo Systems in mid-1987 and Tracor being swallowed by Westmark Systems Inc. last September.

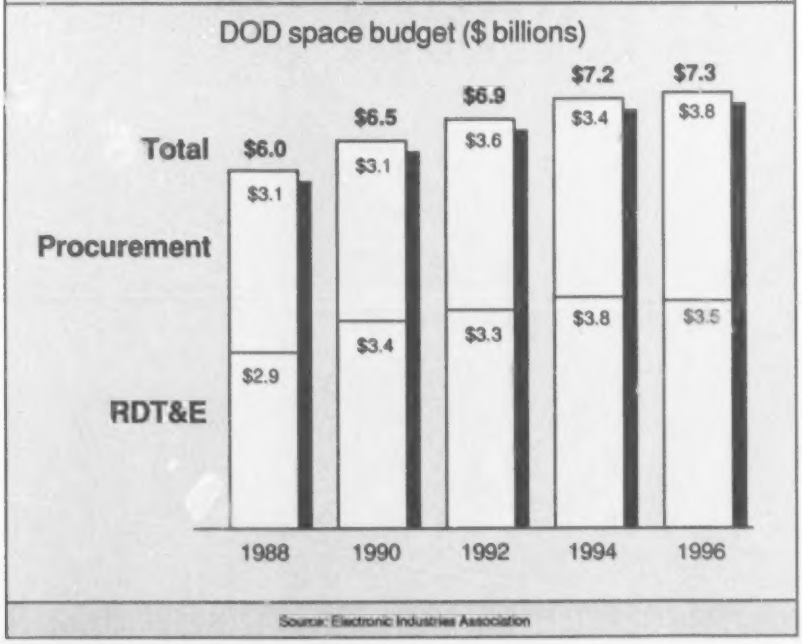
"Some of the other aerospace concerns that have been more aligned to airframe [manufacturing] have more of an interest in getting into fields that we are into," comments David Snyder, senior vice president for domestic and international marketing at GM Hughes Electronics.

The acquisition trend will intensify, some experts say, simply so defense contractors can survive. Breg-

Martin Cook

Heavenly profits

Defense contractors that are focused on space electronics have less to complain about. The space budget will continue to grow strongly through the 1990s



Source: Electronic Industries Association

man at Hambrecht and Quist favors the building block strategy of acquisition that Boeing has been pursuing. "It favors synergies," he says.

Hold that acquisition

But according to DRI's Brown, acquisition activity is in a "reassessment mode" given Wall Street's Black Monday last October. As a result, some acquisitions may be put on hold. With the reduction in prices on the stock exchange, companies are now better value for the dollar. But the sword cuts both ways. The value of the acquiring company's stock has also dropped, lowering the value of its own assets and making funds for acquisition harder to come by.

Other factors play a role, too. Overcapacity, increased cost of audits and intense competition — promoted by the DOD — have all defense contractors firmly wedged between a rock and a hard place. The DOD expects more research, development and tooling costs to be borne by the contractor; profit margins have been cut; and controversial guidelines for increased competition have all helped to lessen the contractors' ability to make a buck. The 1985 Competition in Contracting Act is at the heart of the problem, such that second sourcing and recompetition are being applied across the board, even where they do not make economic sense.

An oft-cited example of this kind of redundancy is the Advanced Tacti-

Defense goes global

While domestic defense contractors are trying to soften the blow of increased competition, foreign companies are having a field day, both in terms of teaming efforts and in terms of potential acquisitions. Hungry foreign investors are bullish on U.S. defense because the U.S. dollar is so low. A case in point is The Plessey Company Plc's purchase of Marion, Massachusetts-based Sippican Inc. for $78 million two months ago. Sippican is in the relatively healthy field of antisubmarine warfare instrumentation and makes for a lucrative move by Plessey. The expectation is for more foreign investment in the near future.

That the defense industry is becoming more international is just a fact of life. The U.S.-NATO two-way street — that used to be an 8-lane freeway into Europe and a cow path into the United States — is slowly becoming equal. The Center for Defense Information estimates that Department of Defense's sales to NATO and Canada have dropped from $9.8 billion in 1984 to $4.5 billion in 1986. At the same time, the DOD increased its purchases from those countries from $2.1 billion to $2.9 billion over the same period. Similarly, two years ago, France beat the United States as the No. 1 source of arms for the third world, and last year, Britain beat France.

Defense nondevelopmental items purchases are growing and almost by definition are foreign sourced. They account for a large chunk of the DOD's foreign sourcing with McDonnell Douglas Corp. producing the British Harrier jump-jet for the Marine Corps; and GTE Corp. building the French RITA-MSE, the battlefield cellular-telephone system.

Teaming efforts between U.S. and foreign companies are also more prevalent. In fact, all of the contenders to replace the Sergeant York division air defense (DIVAD) weapon with the $6 billion forward area air defense system forward heavy (FAADS-FH) are European companies teamed with U.S. counterparts.

The DoD's sales to NATO and Canada have dropped rom $9.8 billion in 1984 to $4.5 billion in 1986

U.S. companies are also more active in foreign markets, even though it is admittedly a hard row to hoe. General Dynamics Corp. is actively selling fighters all over the world, including a recent contract for 170 F-16s to Japan. And Lior Bregman at Hambrecht and Quist Inc. points to Dallas-based E-Systems Inc. and New York City-based Loral Corp. as two that are doing well internationally. Both recently received $500 million contracts internationally, he says.

In research and development, electronic warfare specialist Loral has struck up a deal with Israel. This kind of business move makes sense for all concerned, claims Bregman. Israelis have real battle experience that adds a certain pragmatism and the country also offers relatively cheap labor.

Treaties, summits and elections

Most defense analysts agree that the impact on the 1988 and 1989 defense budgets as a result of the December signing of the intermediate nuclear forces (INF) treaty by President Reagan and Soviet Premier Mikhail Gorbachev will be minimal. Data Resources Inc.'s George Brown echoes most analysts by speculating that the logical consequence of the INF treaty will be a build-up of conventional forces in Europe and more attention paid to verification and sensing equipment. But Brown insists, "it is going to unfold slowly."

As for the resignation of Secretary of Defense Caspar Weinberger, a strong proponent of SDI, and the appointment of National Security Advisor Frank Carlucci to the top defense post, again the short-term consequences for DOD spending will be minimal. In fact, they are likely to get lost in the budget deficit debacle on Capitol Hill. What is more important for the defense outlook is the election in 1988 and the possibility of a Democratic president in 1989.

With defense spending slated for decline over the next few years, a hard-hitting new administration will most likely be inclined to make a strong political stand on the budget deficit. □

Martin Cooke

cal Fighter (ATF) that the Air Force is developing. The nonrecoverable development costs that the two competing teams of Lockheed-Boeing-General Dynamics and Northrop-McDonnell Douglas have to front is estimated at $600 million each. But, only one team will win the contract.

On top of these changes in DOD procurement policy, the Tax Reform Act of 1986 is another thorn in contractors' sides. Although lowering the tax rate, the act effectively eliminates the investment tax credit (ITC) and the completed contract method of accounting for taxes. The removal of the ITC raises the cost of a contractor's capital investment while the cancellation of the contract method means that the contractor can no longer defer taxes until the project is complete. Both negatively affect cash flow.

"The long-term consequence is that capital won't go into the industry and people won't invest in it," says Robert Fraser, vice president for the aerospace practice at the consulting firm of Arthur D. Little Inc., in Cambridge, Mass. Fraser contends that unless something is done to change the current policies, companies will divest out of the defense business and there will be no contractors left. But divestiture is already happening, and not only to the small fry.

Such a case is Eaton Corp., which announced at the end of October that it will sell off its $900 million defense electronics business. Eaton is building the electronic countermeasures for the B1-B strategic bomber that is nearing the end of its production cycle. Faced with the need to make huge investments in its defense business to keep it a viable competitor, the company chose instead to exit. "We are convinced that the financial and management resources we would need to apply in order to get bigger are better employed if directed to commercial markets," writes James Stover, Eaton's chairman.

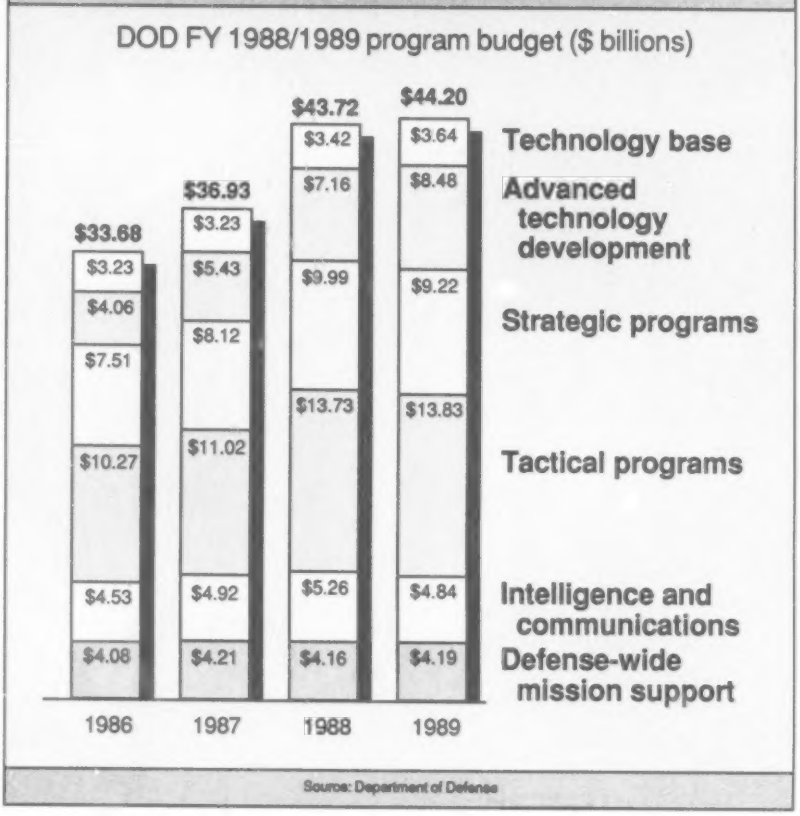
Tough to be optimistic

"It's very tough to be optimistic," says a Lockheed Corp. spokesperson about the state of business. Lockheed, one of eight prime contractors to the Department of Defense, has put its ship-building business on the selling block and has restructured its three aeronautics divisons into one to try to cut costs.

Hughes' Snyder agrees that underfunding, second sourcing and increased audits are putting a strain on the bottom line. It has gotten to the point, he says, that if it does not look like Hughes will make money on a project, the company will not even bid on it. "We won't take a program on if we can't see a way that we can be ultimately profitable," he says.

Where the research dollars go

SDI research requests will fuel growth in the advanced technology development budget



Source: Department of Defense

A recent DoD directive calls for a move back toward some form of cost-plus contracts for certain R&D programs

Both the Congress and the Pentagon have been applying the piecemeal approach in order to increase efficiency and competition. But according to ADL's Fraser, this is not working; the rules that are now being made up, he says, will defeat the very intent of creating a more efficient industry. The darkest scenario would be some form of nationalization: a government-owned, contractor-operated industry. "I hope we will have more sanity than that," says Fraser.

Indeed, a ray of sanity does appear to be shining through. A September directive, number 5000.1, by the DOD's Deputy Secretary of Defense, William Taft IV, calls for more streamlining, more off-the-shelf componentry and subsystems — also known as nondevelopmental items (NDIs) — and a move back toward some form of cost-plus contracts for certain research and development programs. Until now, the trend has been toward fixed-price.

In regard to the cost-plus issue, the directive states: "Contract type shall be consistent with all program characteristics including risk. Fixed-price contacts are normally not appropriate for research and development phases. For such efforts, a cost-reimbursable contract is preferable because it permits an equitable and sensible allocation of program risk between contracting parties." □

AI in Japan: Closing the gap with the U.S.

Japan's commercial activity in artificial intelligence still lags that in the U.S. But it is catching up rapidly

Stimulated by the Fifth Generation Computer Systems Project in Japan and by the renaissance of artificial intelligence research in the United States, many Japanese computer and office equipment makers are now investing heavily in AI technology. Fujitsu Ltd. now has more than 150 AI projects under development. A spokesperson at Fujitsu says that about half of those projects were jointly developed with the customers. And the computer division of Hitachi Ltd. has about 120 projects under development.

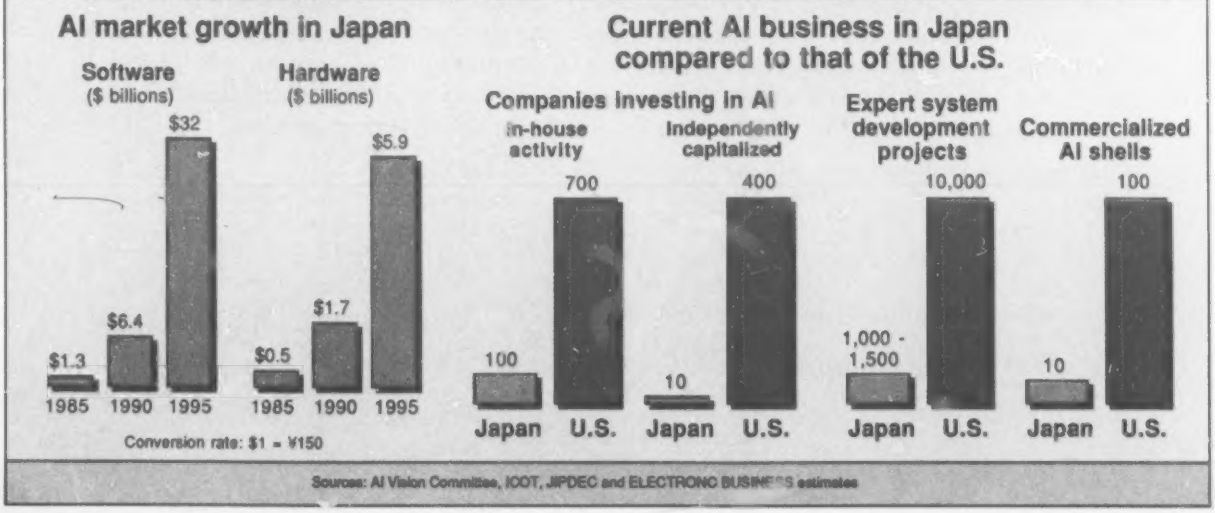
According to a forecast from the AI Vision Committee of the Japan Information Processing Development Center (JIPDEC), the Japanese market for AI software, including commercial software as well as software developed for in-house systems, is expected to reach $6.4 billion ($1 = ¥150); and by 1995, the market will soar to $32 billion. This represents an annual growth rate of 38%. The market for AI hardware, on the other hand, including all forms of computer architecture, will grow to $1.7 billion by 1990; by 1995 the hardware market will reach $5.9 billion. The estimates presuppose that Japan's gross national product (GNP) will grow 3.5% annually.

Nevertheless, for the moment, AI commercial activity is still limited in comparison to the current activity now under way in the United States. In Japan, the estimated number of companies investing in AI, including in-house activity, is less than 100, versus more than 700 in the United States. Similarly, there are only 10 AI businesses in Japan which are purely independently capitalized, while there are more than 400 such companies in the United States. Also, estimates show that at present there are 1,000 to 1,500 expert system projects under development in Japan, while in the United States, around 10,000 appear to be under development.

Additionally, about 2,500 copies of Japanese-made expert system shells have been sold to date. Of those 2,500 shell copies, 2,000 are for 16-bit microcomputers made by NEC Corp., Fujitsu, Hitachi and IBM Japan. The shell name "Sogen," which was developed by AI Soft, an independent business unit from Seiko-Epson, has already sold 1,700 copies since its introduction in June 1986. Until just a few months ago, there had been only one commercialized expert system on the market in Japan. The vendor is Nihon Shakai Iryo Kenkyusyo (Japan Medical Laboratory) and that first product is "Zhang Zhong Qing," an expert system which recommends herbs and other traditional Chinese medicines based on a description of the patient's symptoms fed into the system by a medical technician. Since its introduction in November 1986, the vendor has sold 28 of those software packages.

Last month, Japan Medical also introduced a natural language understanding system called "da Vinci," an intelligent interface to the system which allows a doctor specializing in this medical branch to prescribe herbs by using the knowledge base. The system is run on NEC's popular microcomputer, the PC9801, as well as on the IBM 5550, a machine which has been tailored to the Far East market. When Fujitsu announced its Knowledge System Architecture last July, more than 10 expert systems developed by customers were also demonstrated. They included an Ethylene Cracking Heater Operation and Maintenance Support System demonstrated by Toyo Engineering; and

A look at the artificial intelligence industry in Japan



Sources: AI Vision Committee, ICOT, JIPDEC and ELECTRONIC BUSINESS estimates

from Asahi Joho System, a Machine Diagnosis Expert System. It is now expected that various expert systems, targeting commercial markets, will be introduced by computer users in the next several years.

Japanese LISP

If one includes the sales of expert system shells, machine translation systems and higher language software products used in AI research, or in proprietary expert systems developed by large firms in conjunction with users, then the Japanese AI market is even larger than these product announcements suggest. Nihon Univac Kaisya (NUK), for example, has sold about 10 shell copies of Knowledge Engineering Environment from Intellicorp of Menlo Park, Calif., which runs on NUK's KS301 LISP machine. And DEC Japan has delivered more than 100 OPS5 shells, plus 150 systems offering VAX LISP, a very popular AI language. IBM Japan also is selling the AI products in Japan which were developed by its parent company in the United States. Of course, Fujitsu, Hitachi, NEC, Mitsubishi Electric Corp. and Toshiba Corp. are also marketing their own shells and higher level languages for their own machines.

About 10 computer makers and software houses are also marketing their own developed machine translation systems. To date, computer users have installed about 500 such systems for larger machines. Bravice International, an independent software firm, asserts that it has shipped about 2,200 copies of a machine translation system for microcomputers.

There are, of course, other demand forecasts for AI in Japan. The AI Vision Committee, organized by the Institute for New Generation Computer Technology (ICOT) and JIPDEC, forecasts the demand for both AI in-house and commercial markets. Based on the forecast data of the GNP, the gross revenue of the information and software industry in the forecast period and the result of a questionnaire survey to the computer users in all industries, the Demand Forecast Subcommittee concluded that AI has a bright future in the coming decade.

SHOHEI KURITA

Kurita, the author of about a dozen books on the Japanese computer industry, is also a contributing editor to ELECTRONIC BUSINESS

CALENDAR

UNITED STATES

Jan. 17-20. **Information Services Seminar**. Newport Beach Marriott, Newport Beach, Calif. Semiconductor Equipment and Materials Institute. (415) 964-5111

Jan. 19-21. **PCB Expo**. Omni International Hotel, Orlando, Fla. PMS Industries. (404) 475-1818

Jan. 25-28. **Communications Networks Conference and Exposition 1988**. Washington Convention Center, Washington, D.C. IDG Conference Management Group. (800) 343-6474

Jan. 26-28. **8th AFCEA Western Conference**. Showcase of C³I systems, subsystems and major components. Disneyland Hotel, Anaheim, Calif. AFCEA. (703) 631-6200

Feb. 7-11. **Electronic Distributors Management Institute**. Texas A&M University, College Station, Texas. National Electronic Distributors Association (NEDA). (312) 558-9114

Feb. 17-19. **Fourth Annual Semi-Custom Circuit Program Conference**. San Diego Princess, San Diego. BIS Mackintosh Inc. (617) 655-0001

Feb. 21-24. **CROSSTALK/88**. San Diego Hilton Hotel, San Diego. Electronic Industries Association. (202) 457-4930

CBG Feb. 23-25. **NEPCON West**. Anaheim Convention Center, Anaheim, Calif. Cahners Exposition Group. (312) 299-9311

Feb. 23-25. **BUSCON/88 West**. Disneyland Hotel, Anaheim, Calif. MultiDynamics. (213) 402-1610

Feb. 23-25. **Power Electronics Conference**. Disneyland Hotel, Anaheim, Calif. MultiDynamics. (213) 402-1610

CBG March 7-10. **Spring National Design Engineering Show & Conference**. McCormick Place North, Chicago. Cahners Exposition Group. (203) 964-0000

March 8-10. **Southcon**. Orlando Convention Center, Orlando, Fla. Electronic Conventions Management. (213) 772-2965

March 21-24. **NCGA '88**. Ninth annual conference and exposition dedicated to computer graphics applications. Anaheim Convention Center, Anaheim, Calif. National Computer Graphics Association. (703) 698-9600

CBG April 19-21. **Corporate Electronic Publishing Systems (CEPS)**. McCormick Place North, Chicago. Cahners Exposition Group. (203) 964-0000

April 26-28. **Electronic Distribution Show and Conference**. Las Vegas Hilton Hotel, Las Vegas. Electronic Industry Show Corp. (312) 648-1140

May 9-12. **COMDEX Spring**. Georgia World Congress Center, Atlanta. Interface Group. (617) 449-6600

May 10-12. **Electro/88**. World Trade Center, Boston. Electronic Conventions Management. (213) 772-2965

May 23-26. **SEMICON/West**. San Mateo Fairgrounds, San Mateo, Calif. Semiconductor Equipment and Materials Institute. (415) 964-5111

May 31-June 3. **NCC '88**. Los Angeles Convention Center, Los Angeles. American Federation of Information Processing Societies, Association for Computing Machinery, Data Processing Management Association, Institute for Electrical and Electronics Engineers (IEEE) Computer Society and Society for Computer Simulation. (703) 620-8970

June 4-7. **1988 International Summer Consumer Electronics Show**. McCormick Place, Chicago. Electronic Industries Association/Consumer Electronic Group (EIA). (202) 457-8700

June 7-9. **Robots 12**. Cobo Conference/Exhibition Center, Detroit. Robotics International of the Society of Manufacturing Engineers and Robotic Industries Association. (303) 271-0777

June 12-15. **Design Automation Conference**. Anaheim Convention Center, Anaheim, Calif. Association for Computing Machinery and IEEE. (303) 530-4562

CBG June 14-16. **NEPCON East**. Bayside Exposition Center and World Trade Center, Boston. Cahners Exposition Group. (312) 299-9311

June 14-16. **42nd International AFCEA Convention**. A C³I event. Washington